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ABSTRACT

In a previous study entitled Post-doctoral Education in the Ontario Universities 1969-70 (HE 003 573), the author showed that the majority of postdoctoral students in the Ontario universities in 1969-70 were not citizens of Canada. Upon finding this, the author determined to find out if a significant number of Canadian doctoral graduates continued their training via post-doctoral appointments, and if they did, where this training was taken. The only published statistics relating to this matter are for the U. S. for the academic year 1966-67, so data for 1969-70 are estimated by inferences from the limited data available. Presented are statistics related to Canadian post-doctoral students in the U. S. in 1966-67; test calculation of Canadian post-doctoral students in the U. S. in 1966-67; an estimate of Canadian post-doctoral students outside of Canada in 1969-70; and a calculation of Canadian post-doctoral students (originally from Ontario) outside Canada in 1969-70. (HS)

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Canadians Engaged in Post-Doctoral Studies in Other Countries 1969-70

by

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Canadians Engaged in Post-Doctoral Studies in Other Countries 1969-70

It has been seen that the majority of post-doctoral students in the Ontario universities in 1969-70 were not citizens of Canada.[1] One can then ask if a significant number of Canadian doctoral graduates continued their training via post-doctoral appointments and, if they did, where this training was taken. The only published statistics relating to this matter are for the United States for the academic year 1966-67. In an attempt to obtain more recent information, requests were sent to various agencies in Canada, the United States, and the United Kingdom.[2] The results of this survey were entirely negative; no records are kept on post-doctoral students with the exception of various granting agencies from whom only fragmentary data can be obtained. In view of this absence of hard data, estimates of the number of Canadian post-doctorals studying outside of Canada in 1969-70 can only be made by inferences from the limited data that is available.

1. Canadian post-doctoral students in the United States in 1966-67

The statistics on the number of Canadian post-doctorals studying in the United States in 1966-67 will provide the only possible verification of the methodology to be employed in this paper. According to the report The Invisible University published by the National Academy of Sciences, in the Spring of 1967 there were 264 Canadians engaged in post-doctoral studies in the United States.[3] But this figure is based on the post-doctoral questionnaire returns only and includes post-professional doctorates as well

as post-PhDs. Another study by the National Academy of Sciences reported that in the above group, there were 58 Canadian post-doctorals with U.S. doctorates and 94 Canadian post-doctorals with foreign doctorates (based on the same questionnaire returns).[4] Various statistics in The Invisible University would seem to indicate that the majority of the post-professional doctorates were engaged in the medical sciences as opposed to the basic life sciences and biosciences. Accordingly, it was felt that the subset of post-doctorals with PhD degrees would more closely correspond to the population being considered in the Ontario study.

But compensations must also be made to account for the fact that the questionnaire returns only account for a portion of the total population. Using estimated rates of return of the questionnaires[5] and the distribution of Canadian post-doctoral students according to field of study[6], it is possible to estimate the rate of return for the total Canadian population:

Field of Study	Number of Responses		Response Rate	Estimated Number of Post-Doctorals
Basic Medical Sciences		47	65%	72
Physical Sciences	82			
Biosciences	13			
Engineering	6	112	80%	140
Arts and Humanities	7			
Social Sciences	1			
Other	3			
Total		159		212

The estimated overall response rate is $\frac{159}{212} = 75\%$

Using this response rate, it is now possible to estimate the number of Canadian post-doctoral students with PhD degrees studying in the United States in 1966-67:

	Number of Responses	Estimated Number of Post-Doctorals
With U.S. doctorates	58	77
With foreign doctorates	94	125
Total	152	202

This number (202) corresponds to the post-doctoral population in the Ontario study and can be used to determine the validity of the following methodology.

2. Test calculation of Canadian post-doctoral students in the United States in 1966-67

As no hard data are available on the numbers of post-doctoral students, it is necessary to take an indirect approach. Fortunately, some data are available for Ontario and the United States on the proportions of doctorate recipients who immediately take post-doctoral appointments. While this group represents only a portion of the total post-doctoral population, this is the only group for which we can expect to derive an estimate with any degree of confidence. We have, therefore, divided the post-doctoral population into two groups, "immediate" post-doctorals who are within two years of the PhD and all other post-doctoral students, whom we will refer to as "delayed" post-doctorals. Estimates are available on the percentage of the total post-doctoral population that is represented by the immediate post-doctorals,

and when we have calculated the number of immediate post-doctoral students we will be able to estimate the number of delayed post-doctorals.

Since we are calculating immediate post-doctoral students for the year 1966-67 (to be more precise, the Spring of 1967) we will assume that these students received the doctorate in either 1965-66 or 1966-67. According to the OCGS study, during the period 1964-69 there were 1806 PhD graduates from the Ontario universities; 164 (9.1% of the total) of these took post-doctoral appointments in the United States.[7] For all of Canada there were 696 PhDs awarded in 1965-66 and 780 in 1966-67.[8] Assuming that the percentage of PhD graduates who took post-doctoral appointments in the United States from Ontario can be applied to Canada as a whole and that this percentage is valid for the years 1965-66 and 1966-67, we calculate that 63 PhD graduates from Canadian universities in 1965-66 and 71 in 1966-67 went to the United States for post-doctoral studies. But, according to OCGS only 63% of the PhD recipients from the Ontario universities were Canadian citizens.[9] Applying this percentage,[10] the number of Canadian PhD graduates taking post-doctoral appointments in the United States was 40 in 1965-66 and 45 in 1966-67.

The other major source of Canadian PhD graduates taking immediate post-doctoral appointments in the United States are the American universities themselves. Based on the records of the Department of Manpower and Immigration of Canada for their "Operation Retrieval" programme, it has been estimated that 346 Canadians received their doctorates from American

universities in 1968-69 and 328 in 1969-70.[11] Using statistics on the numbers of Canadians enrolled in PhD programmes in the United States[12] it is possible to estimate the numbers of Canadian PhD graduates in 1965-66 and 1966-67.

	PhD Enrolment	PhD Graduates	%
1969-70	1716	328	0.19
1968-69	1747	346	0.20
1967-68	1813	363*	0.20#
1966-67	1670	334*	0.20#
1965-66	1409	282*	0.20#

* Estimated
\# Assumed to be the same as the 1968-69 value[13]

In 1965-66, 11.6% of the doctoral graduates from American universities took immediate post-doctoral appointments and in 1966-67 the figure was 11.4%.[14] Applying these percentages, the number of Canadian PhD graduates from American universities taking immediate post-doctoral appointments was 33 in 1965-66 and 38 in 1966-67.

It has been seen that 31% of the Ontario post-doctoral students in 1969-70 terminated their appointments within 12 months and it has been estimated that the average duration of a post-doctoral appointment was about 20 months.[15] This is similar to the reported average duration of 1.6 years (about 19 months) for post-doctoral appointments in the United States.[16] We will therefore assume that only 70% of the post-doctoral appointments begun in 1965-66 were continued into 1966-67.

It must also be realized that not all of the PhDs who graduated in 1966-67, and went on to take post-doctoral appointments, actually began these appointments during 1966-67. Recognizing that a post-doctoral appointment may be begun before the PhD has been formally awarded, we will assume that only 75% of the PhD graduates in 1966-67 began their post-doctoral appointments in 1966-67.

Applying these percentages, the number of Canadians holding immediate post-doctoral appointments in 1966-67 is

$$(40 + 33) \times 0.70 + (45 + 38) \times 0.75 = 113$$

But immediate post-doctorals account for only 52% of the total population.[17] The number of Canadians calculated to be holding post-doctoral appointments in the United States in 1966-67 is then 217.

This calculated estimate is greater than the value of 202 shown in section 1 of this paper but there is reason for this. We have assumed so far that all of the Canadians receiving PhDs from American universities and taking post-doctoral appointments held these appointments in the United States. The listing of accepted NRC post-doctorate fellowships (both new and renewal) held in 1966-67[18] shows that this is an unwarranted assumption. There were 14 Canadian fellowship holders who had received their doctorates in the United States taking their post-doctoral training in the United Kingdom and Europe while only one fellowship holder who had received his PhD in the United Kingdom held his appointment in the United States. There may have been other cases of these two-way transfers of post-doctoral students who were financed by other sources but it is not believed that their

numbers would have been very large. The only significant transfer is the flow of Canadians who received their doctorates in the United States and took their post-doctoral training in Canada. It is impossible to determine the exact number but it is estimated that in 1966-67 there were no more than seven such cases.[19]

When the above corrections are taken into account, the calculated estimate of the number of Canadians holding post-doctoral appointments in the United States in 1966-67 is very close to the value from section 1. The methodology developed in this section will now be used to determine the number of Canadians holding post-doctoral appointments outside of Canada in 1969-70.

3. Estimate of Canadian post-doctoral students outside of Canada in 1969-70

The calculations in this section will be done in two parts, Canadian post-doctoral students in the United States and Canadian post-doctorals in other foreign countries (primarily in the United Kingdom and Europe).

(a) Canadian post-doctorals in the United States

In calculating the immediate post-doctoral students in 1969-70 we are interested in those students who received the doctorate in 1968-69 and 1969-70. For all of Canada there were 1108 PhDs awarded in 1968-69 and 1375 in 1969-70.[20] According to OCGS, in 1969-70 there were 640 PhD graduates in Ontario and 89 (14.2% of the total) of these took post-doctoral appointments outside of Canada.[21] If we assume that the proportion of these appointments being held in the United States is the same as for the period 1964-69, we find that 7.2% of the doctorate recipients in 1969-70

took post-doctoral appointments in the United States. The corresponding figure for the period 1964-69 is 9.1% and, as the value appears to be decreasing, we will assume a value of 8.0% for 1968-69. If we assume that the percentage of PhD graduates who were Canadians was still 63%, we calculate that the number of Canadian PhD graduates from Canadian universities taking post-doctoral appointments in the United States was 56 in 1968-69 and 62 in 1969-70.

There is no data available beyond 1967 on the percentage of the doctoral graduates from American universities who took immediate post-doctoral appointments. We will assume that the value of 11.6% is valid for 1968-69 and 1969-70. Applying this percentage to the numbers of Canadian graduates in these two years, we calculate that the number of Canadian PhD graduates from American universities taking immediate post-doctoral appointments was 40 in 1968-69 and 38 in 1969-70.

Applying the methodology developed in section 2, we estimate that the number of Canadians holding post-doctoral appointments in the United States in 1969-70 is

$$\frac{(56 + 40) \times 0.70 + (62 + 38) \times 0.75}{0.52} = 273$$

Since not all of the Canadians receiving PhDs from American universities and taking post-doctoral appointments hold these appointments in the United States, it is necessary to make some adjustments to the above figure. The only situation that we are concerned with is the case where Canadians who received their PhDs in the United States returned to Canada for their post-doctoral training. This correction will be made later.

(b) Canadian post-doctorals in other foreign countries

We were able to utilize the National Academy of Sciences' study on post-doctoral education in the United States in developing and validating the methodology in section 2. Unfortunately, no such information is available on post-doctoral education in other foreign countries. This raises the question of whether post-doctoral education in these countries is more similar to post-doctoral education in Ontario or in the United States. During the past decade there has probably been a more rapid expansion in the graduate schools in Ontario than in the United States, the United Kingdom, or Europe. We will, therefore, assume that post-doctoral education in these other foreign countries is more similar to the situation in the United States and that the parameters developed for post-doctoral education in the United States can be applied to these other countries as well.

We have previously estimated that the number of Canadian PhD graduates from Canadian universities taking post-doctoral appointments in the United States was 56 in 1968-69 and 62 in 1969-70. According to OCGS, during the period 1964-69, graduates from the Ontario universities taking post-doctoral training in the United States represented 50.8% of the graduates from the Ontario universities who left Canada for their post-doctoral studies.[22] Assuming that this figure is valid for the years 1968-69 and 1969-70 we calculate the number of Canadian PhD graduates from Canadian universities taking post-doctoral appointments in foreign countries other than the United States to be 54 in 1968-69 and 60 in 1969-70.

It has been estimated that 79 Canadians received their doctorates in these foreign countries in 1968-69 and 149 in 1969-70.[23] Assuming that 11.6% of these took immediate post-doctoral appointments, we calculate that the number of Canadian PhD graduates from these countries taking immediate post-doctoral appointments was 9 in 1968-69 and 17 in 1969-70.

We therefore estimate that the number of Canadians holding post-doctoral appointments in these countries in 1969-70 is

$$\frac{(54 + 9) \times 0.70 + (60 + 17) \times 0.75}{0.52} = 196$$

The total number of Canadians holding post-doctoral appointments abroad in 1969-70 (before the corrections discussed earlier have been applied) is

$$273 + 196 = 469$$

4. Calculation of Canadian post-doctoral students (originally from Ontario) outside of Canada in 1969-70

Assuming that the percentage of Canadian post-doctoral students abroad who came originally from Ontario is the same as the percentage of PhD graduates from the Ontario universities compared to Canada as a whole (about 46% for 1968-69 and 1969-70),[24] the uncorrected estimate of the number of Canadians who came originally from Ontario and who are engaged in post-doctoral studies outside of Canada in 1969-70 is 216.

This figure must be reduced to account for Canadian post-doctoral students in the Ontario universities in 1969-70 who received their doctorates outside of Canada. From the post-doctoral questionnaire returns it was found that 19 of the 62 Canadians holding post-doctoral appointments in Ontario in 1969-70 were in this category, or 23 of the estimated 622 post-doctoral students in Ontario. Applying this correction, the estimate of

the number of Canadian post-doctoral students (originally from Ontario) outside of Canada in 1969-70 is 193.

In our opinion, this estimate is probably on the low side. The numbers of Canadians receiving their doctorates outside of Canada were based on Operation Retrieval records which indicate the numbers of Canadian PhD recipients in foreign countries who have some interest (in some cases probably very slight) in obtaining employment in Canada. The actual numbers of Canadian PhD graduates in these countries may be somewhat higher. The Operation Retrieval records, however, provided the only available estimate.

FOOTNOTES

1. L. C. Payton, Post-doctoral Education in the Ontario Universities 1969-70, Council of Ontario Universities, Toronto, 1972, p. 14.

2. The agencies surveyed were:

   Canada - Department of Manpower and Immigration, Medical Research Council, National Research Council, and Statistics Canada.

   United States - Council of Graduate Schools in the United States, Institute of International Education, National Academy of Sciences, and National Center for Educational Statistics.

   United Kingdom - Association of Commonwealth Universities, Medical Research Council, Science Research Council, Social Science Research Council, and University Grants Committee.

3. The Invisible University, National Academy of Sciences, Washington, D.C., 1969, p. 307.

4. Mobility of PhDs Before and After the Doctorate, National Academy of Sciences, Washington, D. C., 1971, p. 8.

5. The Invisible University, p. 260

6. Ibid, p. 307.

7. Survey of Employment of Ontario PhD Graduates - 1964-69, Ontario Council on Graduate Studies, Toronto, 1970.

8. Degrees, Diplomas, Certificates Awarded by Degree-granting Institutions, 1969-70, Dominion Bureau of Statistics, Ottawa, August 1971, p. 14.

9. Survey of Employment of Ontario PhD Graduates - 1964-69.

10. As there were no data available to indicate whether Canadians and non-Canadians behaved in the same fashion, we have assumed that this has been the case.

11. Max von Zur-Muehlen, The PhD Dilemma in Canada, Economic Council of Canada, Ottawa, 1971, p. 72.

12. Open Doors, Institute of International Education, New York, 1965-66 through 1969-70.

13. It is unlikely that this ratio did in fact remain constant. While data were available on the numbers of doctoral graduates in the United States, there were no data on the enrolments in PhD programmes and it was therefore impossible to derive better estimates of this ratio. In any case, it is unlikely that the changes would be large over the time span in question.

14. The Invisible University, p. 60

15. Post-doctoral Education in the Ontario Universities 1969-70, p. 31.

16. The Invisible University, p. 93

17. Ibid, p. 52.

18. Annual Report on Support of University Research, 1966-67, National Research Council of Canada, Ottawa, pp. 271-275.

19. Ibid, pp. 276-277

20. Degrees, Diplomas, Certificates Awarded by Degree-granting Institutions, 1969-70, p. 14.

21. Supplement #1 to Survey of Employment of Ontario PhD Graduates - 1964-69, Ontario Council on Graduate Studies, Toronto, 1971.

22. Survey of Employment of Ontario PhD Graduates - 1964-69.

23. The PhD Dilemma in Canada, p. 72

24. Degrees, Diplomas, Certificates Awarded by Degree-granting Institutions, 1969-70, p. 14.